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FIRE DETECTION WITH WIRELESS VIDEO CAMERA USING MATLAB

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Abstract: The main aim of this paper is to detect the fire based on the image processing with wireless video camera. This system provides an automatic detecting system for fire using wireless video camera and PC with MATLAB. The video will be transmitted to the receiver using AV transmitter. At PC section, end, this can be seen on PC through MATLAB. It is a very low cost survey line system used to monitor a larger area. Present work is to detect flames in video by processing the data captured by a wireless camera.
Keywords: AV, LCD, MATLAB,PIC, RISC

I.INTRODUCTION

This paper focuses on optimizing the flame detection by identifying gray cycle pixels of the flame, which is generated because of spreading of fire pixel and the area spread of flame. These techniques can be used to reduce false alarms along with fire detection methods. The novel system gives optimized way to detect the fire in terms of less false alarms by giving the accurate result of fire occurrence. The strength of using video in fire detection is the ability to monitor large and open spaces. The novel system also give the opportunity to adjust the system by applying different combination of fire detecting techniques which will help in implementation of system according to different sensitive area requirement.

The objectives of the paper:

1. Detecting fire and automatically controlling by using image processing.
2. Image processing through PC with MATLAB.
3. Web camera transmission and receiving through PC with MATLAB
4. To provide very low cost Fire Detection surveillance system to monitor a large area

II.BLOCK DIAGRAM

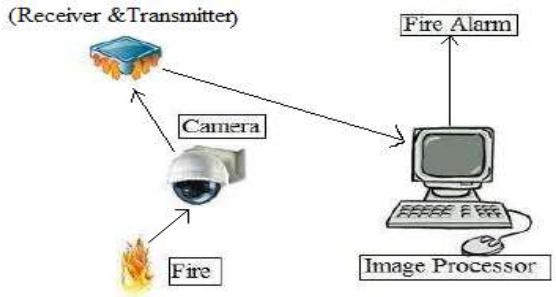

Figure 1:Block Diagram

Video camera is continuously monitoring the surrounding where the camera is been installed. The video that is capturing is purely a composite video. These signals are passed to the receiver through an antenna. The received video is also a composite video. The receiver is tuned in such a way that it should accept the video signals from the transmitter. This receiver is interconnected to the TV tuner which acts as an interface between receiver and the PC.

The received video is converted into frames using MATLAB. The threshold value for the red colour in the frame is compared with the predefined maximum threshold value that is been set for the red colour. If the threshold value exceeds the predefined value then it is sensed that there is a fire in the surrounding. Then the PC sends signal to the buzzer circuit. Then buzzer circuit gets activated. Appropriate message is displayed on the LCD along with the alarm.

III.IMPLEMENTATION

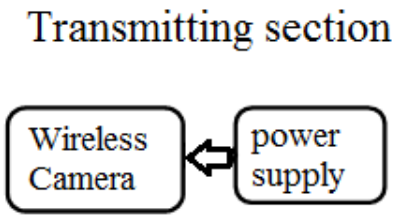

Figure 2:Transmitter

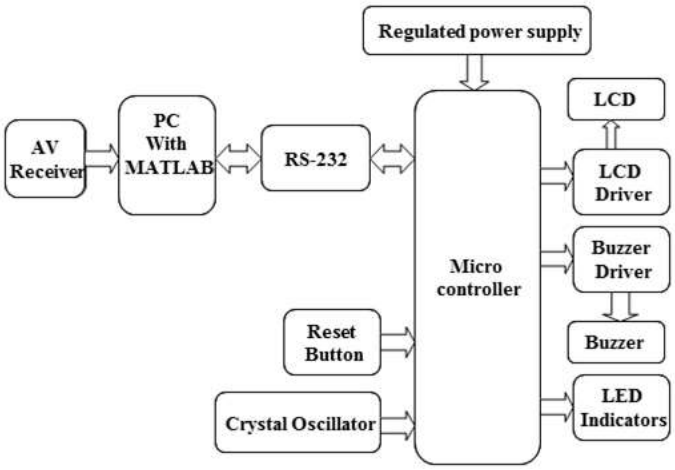

Figure 3:Receiver

Transmitter Part:

The output of the video camera which is pure composite video signal and is fed to the transmitter. The transmitter circuit generates a continuous frequency of 100MHz approximately, that is used to form a permanent link between the transmitter and receiver, and this is known as carrier frequency. The output of video camera is fed to this carrier input as a modulating wave. This is a frequency modulated radio transmitter. The radiating power of the transmitter is less than 20mw, such that the range between transmitter and receiver can be less than 25 feet. In the amplifier section 2 N 3866-NPN Transistor is used to amplify the input signal.

Microcontroller (16F73):

PIC16F73 is a RISC microcontroller that means that it has a reduced set of instructions, more precisely 35 instructions. All of these instructions are executed in one cycle except for jump and branch instructions. According to what its maker says, PIC16F73 usually reaches results of 2:1 in code compression and 4:1 in speed in relation to other 8-bit microcontrollers in its class.

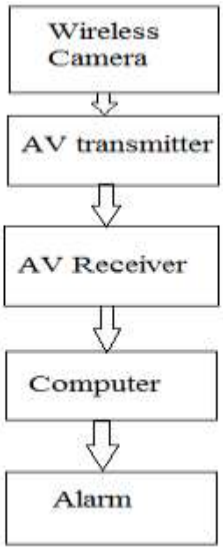

Figure 4:Abstract Design

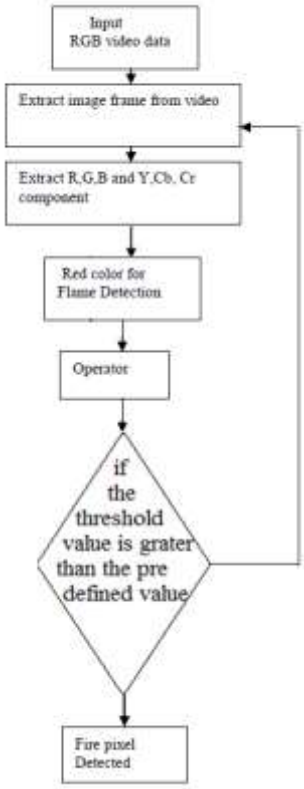

Figure 5: Flow Chart

Software Tool used:

MATLAB is a multi-paradigm numerical computing environment and fourth-generation programming language. Developed by Math Works, MATLAB allows matrix manipulations, plotting of functions and data, implementation of algorithms, creation of user interfaces, and interfacing with programs written in other languages, including C, C++, Java, Fortran and Python.

1) Extraction of images from the video

A video file consists of frames. These frames when appear before us in a rate more than our perception of vision, gives a sensation of an object moving before us, by looking just at the screen on which frames are appearing at high rate.

Thus one can say that frames are the fundamental entity of a video file. Frames can be obtained from a video and converted into images. To convert a video frame into an image, the **MATLAB** function '**frame2im**' is use

2) RGB colour model

A fire image can be described by using its colour properties. There are three different element of colour pixel: R,G and B. The colour pixel can be extracted into these three individual elements R,G and B, which is used for colour detection. RGB colour model is used to detect red colour information in image. In terms of RGB values, the corresponding inter-relation between R, G and B colour channels: R>G and G>B. The combined condition for the captured image can be written as: R>G>B. In fire colour detection R should be more stressed then the other component, and hence R becomes the domination colour channel in an RGB image for fire. This imposes the condition for R as to be over some pre- determined threshold value RTH.

All of these conditions for fire colour in image are summarized as following:
Condition1: R > RTH
Condition2: R > G > B.
Where RTH is the Red colour threshold value for fire.
According to the algorithm presented in [2], pixel P located at (x, y) in the image is classified as fire if the following rules hold:
(1)R(x; y) > Rmean
(2)R(x; y) > G(x; y) > B(x; y)
where Rmean is the mean of the red component of the image, R(x, y), G(x, y), and B(x, y) represent red, green and blue values for P, respectively.

00	01	11	10
01	01	10	11
10	11	01	10
00	01	11	11

R	G	B	Color indication
0	0	0	Black
0	0	1	Blue
0	1	0	Green
0	1	1	Cyan
1	0	0	Red
1	0	1	Magenta
1	1	0	Yellow
1	1	1	White

3) Grey scale Image model:

In this project we are converting the colour model into the grey scale pixels. As mentioned earlier, the video consists of frames. Each frame is converted into respective grey scale pixels. In grey scale model, each frame is designed by the binary digits. The black pixel colour indicates the binary digit "0" and the white pixel colour indicates binary digit "1". In this manner the entire frame is set up by referring the look up table. This look up table consists of binary values for various colours that are present in the RGB model. Based on this model, we are defining the cut-off value for fire pixels. It is the characteristic of the fire pixels which has maximum intensity for red colour. This differentiates from other red colour objects which are present in the surroundings.

4) Colour Detection

Any image in Red-Blue-Green format has each pixel in it possessing a set of values for each of the 3 channels. If we know the range of R-B-G values for a particular colour we want to detect, then while processing the image, we will look only for those pixels which have R-B-G values in the range of what we want. We will check for each pixel whether the value of a certain channel (the higher the value the more the colour is present) is higher than a particular threshold value, and also that the values of the other two channels are LESS than a particular threshold value. If the pixel meets that condition, it is deemed to be of that the basic colour, and we designate it white in the resultant image. Otherwise the pixel is kept black. However, lighting conditions in the background may adversely affect the saturation values of flames resulting in similar R, G and B values which may cause non flame pixels to be considered as flame coloured. Therefore, saturation values of the pixels under consideration should also be over some threshold value.

5) Decision-making

To reduce false alarms induced by fire-coloured moving objects, one of the two following conditions must be met in order to issue the alarm: (1) the bounding boxes of the fire region in question and of any other object being tracked do not overlap; (2) there is overlap in the bounding boxes but the distance between the current position of the overlapped object and its position when it emerged in the scene does not cross a given threshold (typically50pixels). The second condition ensures that only stationary objects are considered as putative fire regions. A quasi-static object exhibiting a fire-like dynamic texture (e.g., a full-bodied person who is shaking but slowly moving and wearing fire-textured clothing) complies with these conditions and, thus, may generate an undesired fire alarm. If the object is of a known non-fire category, the alarm can be discarded immediately.

IV.RESULTS

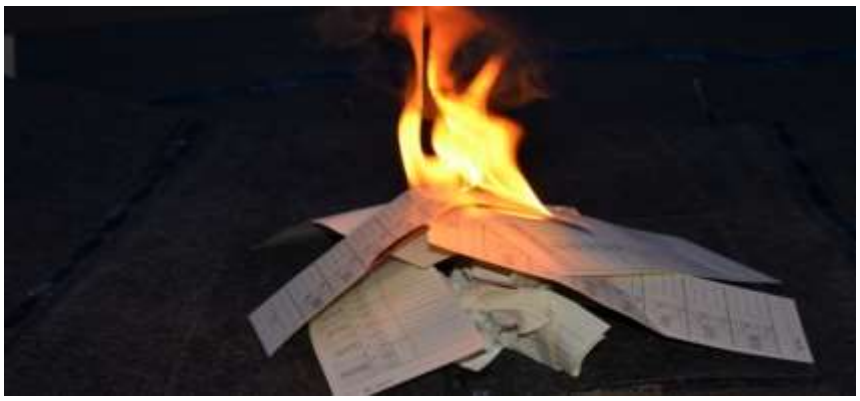

Figure 6: Original Image

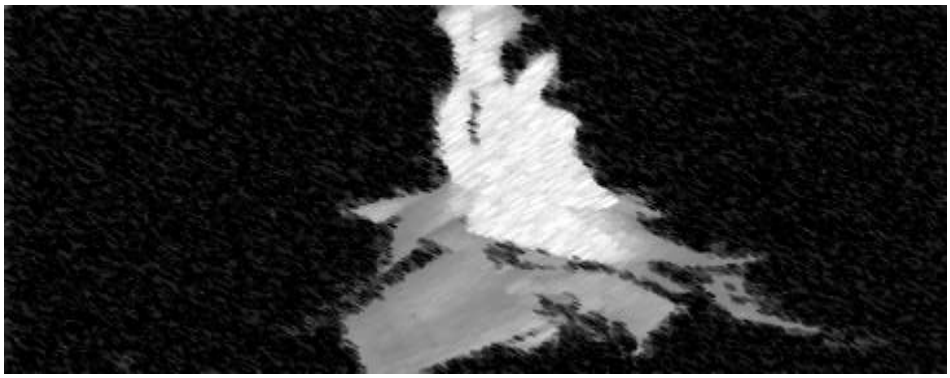

Figure 7: Grey Scale model

Figure 8:Experimental Set Up

V. CONCLUSION

In this project, we present a fire detection system which takes into consideration fire pixels for 3 different colour spaces. For each colour space, we extract a set of features and determine the best feature set using different feature selection algorithms. Finally, the input image is classified as either fire or non-fire through various classification methods. The experimental results demonstrate that more than 90% of correct fire classification ratio is achieved when the best selected feature set is used with appropriate classifier.

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